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UNIT I

THE NORMAL ANIMAL

4-H
VETERINARY SCIENCE

Extension work in "Agriculture, Home Economics and subjects relating thereto," The Cooperative Extension Service, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, Cooperating with the Counties and the U.S. Department of Agriculture
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4-H VETERINARY SCIENCE

UNIT I - THE NORMAL ANIMAL

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INTRODUCTION

4-H Veterinary Science Program
First Year
Applied Veterinary Science

What is a veterinarian? He is a Doctor of Veterinary Medicine or simply an animal doctor. However, the work of a veterinarian goes far beyond the animal itself.

Veterinary science has many branches, as animal health has a great influence on human health, comfort, recreation and livestock value.

The field of veterinary science includes the protection of the world's food supply by improving animal health and producing better breeding stock. In areas where disease, insects and parasites are a hazard to man's health, veterinarians study the problem to keep both man and animal healthy.

One veterinarian might treat most kinds of animals while other veterinarians may specialize and work with only one. Therefore, specialists may focus their efforts on other animal-related projects.

The field of veterinary science is not restricted to a small town or a large city. Veterinarians are many places, performing many varied jobs to help keep mankind healthy and animals well and productive.

Some veterinarians may work for government, industry, educational institutions, service organizations, or the armed forces. Each helps to protect people from diseases of animal origin.

Men and women who want to become Doctors of Veterinary Medicine (D.V.M.), must go to college and study for many years. Their choice of a profession in veterinary medicine means 8 to 10 years of hard work and time-consuming education. In this veterinary science project, you will study some of the elementary facts about animals that veterinarians learn during their course of study.

Remember as you read through this unit, you will find that close observation is necessary in really knowing the normal animal. This has an important bearing on recognition of the abnormal or sick animal. Although it is not necessary to have your own animal for this project, it would be best to have one close that you can watch.

There are many interesting and valuable experiences to be gained from the 4-H Veterinary Science Project, even though you may have no intention of becoming a veterinarian or a veterinary technician. This background information about animals can be applied to other animal-related careers as well, such as managing a ranch or running a pet store. It will also give you a better understanding of animal health and care. This is valuable, as a livestock or pet owner, because by having this accurate information a more meaningful discussion is likely if a veterinarian is needed.

Parents:

The objective of the 4-H Veterinary Science Program is to introduce the fundamentals of animal health, and the broad scope and many fields of veterinary medicine. The teaching material will stress the importance of recognizing the normal animal, its structure, function and appearance, in contrast to the abnormal or sick animal.

ATTITUDE AND BEHAVIOR

Words to Know:

attitude: the way an animal acts, reacts, behaves or performs in a normal situation. This helps in judging an animal's physical condition.

behavior: the way an animal acts or conducts itself; *mental* attitude. This is also referred to as disposition or temperament.

breed: a special type of animal or plant. For example, a German Shepherd is one breed of dog. This is a subdivision of species.

diagnose: to make a careful examination of an animal and study the signs or changes in attitude and behavior to determine what is wrong with an animal.

normal: usual or regular. Normal is used in this book as what an animal usually does. A change from this "normal" is called "abnormal."

pitch: highness or lowness of a voice or note.

species: one of a kind. All dogs belong to one species. All cats to another.

stance: the way a person or animal stands.

signs: the indication that something exists which is evidence of a disease.

After reading this section you should be able to answer the following questions:

- Define attitude and behavior. How can an animal's attitude and behavior be seen?
- How can posture and movement indicate an abnormality?
- What do animals use their voice for?
- How can appetite help you determine if there is something wrong with an animal?
- Why is it so important to know the normal animal?

Note: For the member to understand this section, it is extremely important to have an animal to observe close by, as many hours of looking are necessary to learn the "normal" animal.

ATTITUDE AND BEHAVIOR

The animal kingdom is classified as living beings that are different from plants, as they have ability to move. These animals include many types which may fly (birds), swim (fish), crawl (snakes), or walk (horse, dog, cat). While learning these lessons, the word "animal" may include any of these.

For thousands of years man has been taming wild animals. Through the years, he has improved his breeding stock from those animals which served him best, until he had animals that served his needs for food and clothing.

While man was taming wild animals for food and clothing, he became aware that some animals provided companionship and these became pets. Other animals proved to adapt well to helping man do some of his work, and these became work or recreation animals.

Man even learned to communicate with animals by patiently teaching them useful jobs, while making certain sounds at the same time, then rewarding the animal when the job was finished. He found it did not take long for these animals to be quite useful on his command.

While working with animals, it became clear that one animal may act one way when another acted somewhat differently, but still both were healthy and normal. Through these observations man became familiar with normal attitudes and habits which helped him realize clearly that animals act different when sick, hungry or afraid.

1.1 **Attitude of a sick calf.**

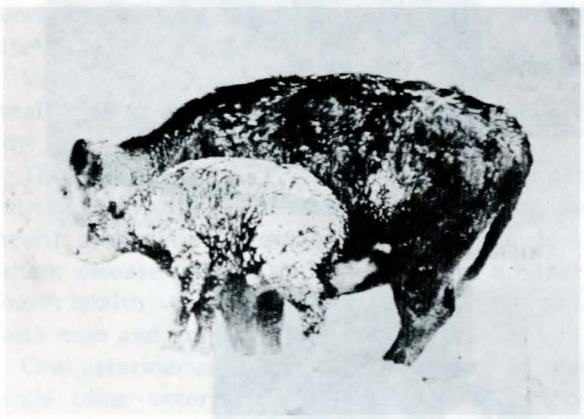
1.2 **Attitude of a healthy calf.**

The attitude of an animal is its normal action, reaction and performance by which you should judge its physical condition. Behavior is the mental attitude, sometimes referred to as temperament or disposition. An animal's attitude and behavior can be seen in posture, movement, appetite and voice, as you will see later.

While you are studying your own animal, at play, work, or at rest, compare it with others of its own species (kind). Each animal is different in its attitude and behavior, just as each of us is different in the way we play, work and rest. The attitude and behavior of different species will vary considerably. Different breeds do not have as many differences. There are variations even within the same family. Your knowledge of these differences in your animal under all conditions is essential in learning the normal behavior and attitude of the animal. These conditions include hot or cold, wet or dry, under stress or not. To learn this takes a lot of time and close observation of your animal.

POSTURE OR STANCE

Abnormal stance does not always indicate a disease, but if accompanied by other signs, it may show the location and seriousness of a disease. A dog, for example, will usually find a cool spot to lie in hot weather and be considered normal. If the same animal chooses to lie on the cold ground when the temperature is low, it may indicate illness.



1.3 Normal stance for this weather.

A horse that continually shifts its weight from one limb to another indicates discomfort that could be evidence of foot or leg problems. In cold weather some animals adjust by fluffing their hair or feathers to keep warm. These attitudes are normal for cold but would be abnormal for warm weather.

It is very important to know all of the normal attitudes under nearly all conditions to be able to recognize the sick animal.

The healthy animal may vary from running and playing to lying quietly and sleeping, so to learn the normal is going to take a lot of time and very close observation. Some people are able to see and learn these animal attitudes much more easily than others.

An abnormal change in stance, along with other signs, may enable a veterinarian to diagnose a specific disease. Laminitis (founder) is an example where stance and attitude are extremely important. A horse who has had a change in diet or has gorged itself feeding may develop an inflammation (redness, pain and warmth) of the feet known as laminitis. Even though it is the digestive organs that are involved, the feet show the presence of the problem. Dogs, cats and hogs do not normally get laminitis, so the veterinarian would draw a different diagnosis if they were lame.

An unusual stance must not be considered normal until abnormalities are ruled out. To do this, you must watch often and observe closely. Severity of pain or distress produces extremes in stance. Pain may not be the only cause for a change in attitude. Simple annoyance can cause stance or attitude changes. A dog may paw at a bone caught in its teeth or scratch at itching skin because of annoyance.

If you make a habit of observing your animal closely and comparing to its normal, you will be able to tell when it is in need of help or veterinary assistance.

MOVEMENT

Closely linked with stance is the normal movement of your animal. Abnormal movements or actions mean changes in attitude or behavior. Frequent shaking of the head, constant licking, repeated kicking, pawing, squinting, blinking, or excessive scratching may show a serious condition, or only that the animal is annoyed.

Movement of the legs while an animal is running, walking or moving is called the gait. Abnormalities may affect movement in many ways. If your pet has arthritis, for example, its walk may become shuffling or stumbling. Again, the normal must be known to recognize the abnormal. Much can be determined by watching the gait.

In some animals, a stiffness of the limbs when moving indicates disease, but in others, may be normal. A horse approaching as a newcomer to the others, approaches cautiously and jogs the last few steps, legs stiff and head erect. This form of movement or strutting is often seen in animals during mating time or when pleased, excited or curious.

Again, what is normal to one animal or to one breed may be abnormal to the next. Each animal exhibits movements which are considered normal, but occasionally you will find a normal animal behaving abnormally. Some horses paw the ground repeatedly, dogs limp and birds flap their wings, if they know it will attract attention. Be alert to these tricks and give your animal attention if it needs it, but don't forget that sometimes abnormal action is a warning of problems.

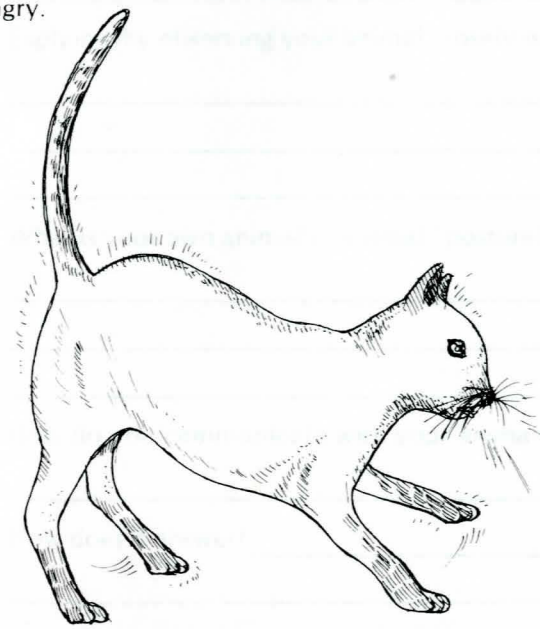
VOICE

An animal's voice is important as it is a means of communicating with you and others of its kind. Vocal communication is used to indicate hunger, loneliness, pain, distress, the mating urge, and to call other animals. Within those few basic calls are many variations which you will need to know.

Each animal species has voice sounds that are characteristic for that species, and from these sounds you should be able to determine which type of animal made the noise even without seeing it. The familiar whinny of a horse is usually a loneliness call; if one horse is separated from its companions, it signals its problem by a whinny. The nicker, a softer sound, sometimes indicates it wants to be fed or is begging. A mare may be communicating with her foal with a very similar soft nicker. Horses also communicate in other ways. The snort, may indicate pleasure, excitement or alarm. A shrill squeal is a horse's warning to another, often exhibited to new additions or during the first stage of mating.

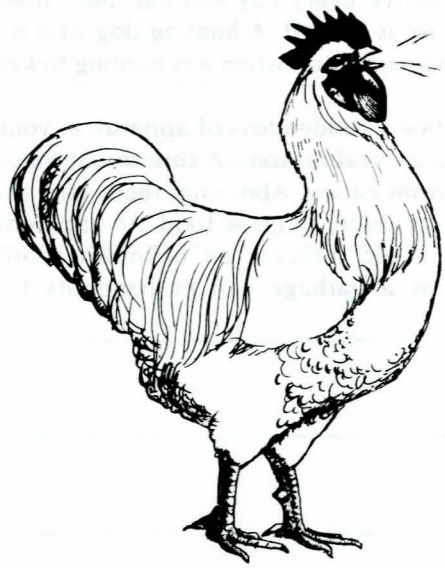
New-born puppies have a strong distress call which is given during emotional disturbance and pain. Adult dogs also have different sounds to indicate distress or happiness. In addition, they use a variety of sound patterns such as the low, throaty growl, sharp threatening bark of the watchdog, or the excited yelping of a dog that has cornered a cat.

Cats are shown to have a very limited number of sounds. Their voice is heard in relation to sexual behavior, fighting and anticipation of feeding. They murmur and purr when friendly or in a relaxed mood. When angry, attacking, mating or withdrawing from an uncomfortable situation, their voice is strained and high. Cats can also communicate with their owners when seeking to attract attention, especially when hungry.



1.4 One normal voice for a frightened cat is a hiss.

Birds, too, have a variety of voices which can communicate their feelings to an alert owner. The crowing of a rooster is considered a territorial call, warning all other males to stay clear of his hens. The clucking of a



1.5 One normal voice and attitude of a rooster is crowing.

hen and quacking of a duck, while tending their brood, are sounds of instruction and contentment.

A cow's bawl (moo) when shut away from her calf will have a different frequency or pitch (highness or lowness) than when she's hungry or calling to the herd. A bull's voice may be a deep bellow and is easily recognized once it has been heard. A calf, like all young animals, uses its voice to call for its mother, when hungry, or in distress.

The pig uses his voice to indicate his basic needs and moods. The pig, when rooting for food, has a characteristic grunting sound or when startled may have an explosive woof. The high pitched squeal, so often heard during feeding time, is emitted when one bites or frightens another.

Sheep and goats bleat when curious, hungry or in pain, and each cry is of a different pitch. Like all other animals, their distress cry is higher and more pronounced than their regular call for food or company from the flock.

APPETITE

An animal's appetite is one of the best indicators of its well-being. If you have ever watched a group of animals eating, you might have noticed that some are different in the amount and way they consume the food. This is important to watch when studying your animal.

An animal with a big appetite may be seriously ill if any part of its meal is left. On the other hand, an

animal that eats very little may miss a meal and still be perfectly healthy. The amount eaten and the way it is eaten may depend on the weather, number of feedings per day, amount of exercise, and may indicate the health of the animal. A mare in foal (pregnant) may eat more than a non-pregnant mare, and a dog that is active every day will eat more than one whose exercise is limited. A hunting dog who is inactive will need more food when it is hunting to keep its energy high.

If you notice a sudden loss of appetite in your pet, it may be for several reasons. A sore throat may keep the animal from eating. Abnormal teeth may also interfere with its ability to chew food. An apparent loss of appetite could indicate an unknown source of food, such as a garbage can or handouts from a neighbor.

SEXUAL ACTIVITY

(Estrus, heat, mating time)

A most noticeable attitude change that is unusual, but normal, is the attitude of an animal in the mating season. This is the time in the animal's life when the desire for a mate is greatest. These conditions are brought on by chemical changes within the animal body. During estrus, many abnormal appearing activities may occur; however, these actions are perfectly normal for that period in the animal's sexual life.

Each species of animal, during estrus, may exhibit different signs; for example, the cat may meow excessively and crouch, while the cow may bawl frequently, eat less, and appear very restless.

It is important to recognize activities of estrus as normal. Knowing about these important signs can help determine when to allow or to prevent mating, or being aware of this may simply let you feel at ease, recognizing there is nothing wrong with your animal.

Always consider every possibility before deciding that your animal is ill, but if you suspect a problem, don't wait too long before getting professional help.

ATTITUDE AND BEHAVIOR

Member Activity: See if you know the following information about attitude, behavior and your own animal.

1. Define the following terms:
   a. normal animal

   b. attitude

   c. behavior

   d. simple annoyance

   e. gait

   f. abnormal

2. What kind of animal do you have?

3. How old is it?

4. How long have you had it?

5. As explained in the reading material, each animal has its own differences. List any peculiarities or outstanding habits your animal has.

6. Explain why observing your animal closely is important.

7. What is your own animal's "normal" posture? How does it change when something is wrong?

8. How do you communicate with your animal? Describe how.

   How does it answer?

9. Can you recognize the meaning of the different sounds and actions your animal makes? Describe the sounds for each of the calls below.

   a. hunger _____

   b. pain _____

   c. excitement _____

   d. anger _____

   e. greeting _____

10. What does your animal eat? _____

_____

_____

_____

11. How much does it eat per day? _____

_____

_____

_____

12. Is its appetite normal? Name some reasons its appetite may vary. _____

_____

Extra Activity: Visit a dairy farm where sexual signs (heat) in dairy cattle are observed to determine the time of breeding.

Unit I, Lesson II

SKIN, MEMBRANES AND INTESTINAL DISCHARGES

Words to Know:

coat: hair, wool, or feathers that are attached to the skin of animals as a covering.

ingestion: to take in as in eating.

mucous membranes: moist covering that lines the natural body opening such as the eyelids, mouth, nostrils, throat, etc.

pigments: the substances in cells and tissues that give color to the skin and coat. Differences in amounts and kinds of pigments make the different colors.

skin: the tissue covering the body of an animal.

After reading this section you should be able to answer the following questions.

- What signs can be given by the coat and skin of an animal that show it is healthy?
- Define the term pigments.
- What are some changes in the coat and skin that could indicate something is wrong with your animal?
- Where are mucous membranes located? What are some changes in the mucous membranes that should be watched for?
- What are some changes you should watch for in your animal's feces?

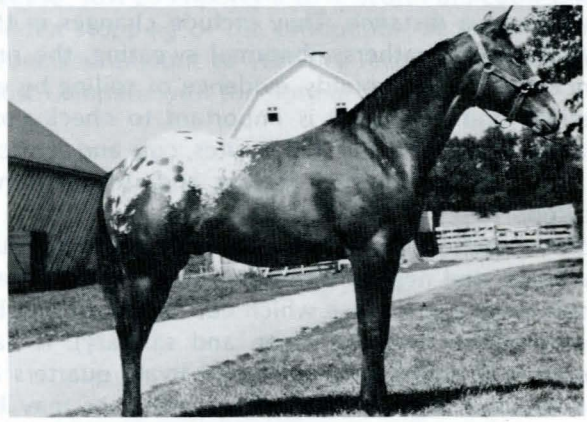
THE SKIN, MEMBRANES AND INTESTINAL DISCHARGES

Although abnormalities in the attitude and behavior of your animal are more obvious signs of health, the skin and hair coat, mucous membranes and intestinal discharges are also important to watch to learn more about the normal animal.

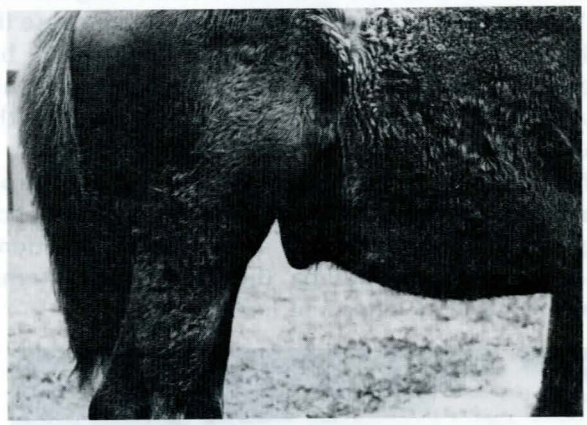
SKIN AND COAT

The skin and coat (hair, wool, feathers, scales) are very important signs of the health of an animal. The skin, which changes in thickness from one part of the body to another, should be soft, pliable (bends freely) and waxy. Over certain areas of the body the skin will adhere (cling), as over the rib cage of a horse or cow. In dogs, cats and rabbits, the skin is loose in the neck and shoulder area. By picking up a large fold in your hand you can determine the pliability of the skin.

The coat of an animal should be smooth and glossy and the feathers of birds lustrous (shiny). When the hair coat or feathers lose their luster and the skin becomes scurfy (scaly) and dry, poor feeding or changes in feeding could be the reason. The long, rough, heavy coat an animal grows during the winter months should not be mistaken as abnormal; it is provided by nature to give protection against severe cold and to prevent too rapid loss of heat from the body. Shedding of the winter coat is normal in the spring or when an animal, usually kept in the cold, is moved to warmer quarters. Constant shedding in the fall or early winter, except in very warm quarters is abnormal.



2.1 Smooth glossy hair coat.



2.2 Rough hair coat.

PIGMENTS

The color of the skin, feathers and hair coat varies a great deal in different species and breeds of animals. The materials that give the color to the skin and coat are known as pigments. Two bay horses or two red rabbits may be entirely different shades, but are still called "bay" and are shades of "red". The variation in colors comes from the amount and kind of pigments present.

MELANINS. (Mel-an-ins) Dark colors, showing the presence of melanin pigment are found in the feathers, skin, coat and eyes of birds and other animals.

Melanin is also responsible for pale yellow, tawny, buff, ruddy brown and black colors of hair.

The intensity (how strong it is) of a color depends upon the amount of melanin present. In the skin, for example, very little pigment means that the animal is light-skinned; while greater deposits make the animal dark-skinned.

An animal or person that is milky white is known as an albino. The skin of an albino contains no pigmentation. A pink cast to an albino's skin and eyes is caused by the redness of the blood in the vessels near the skin surface.

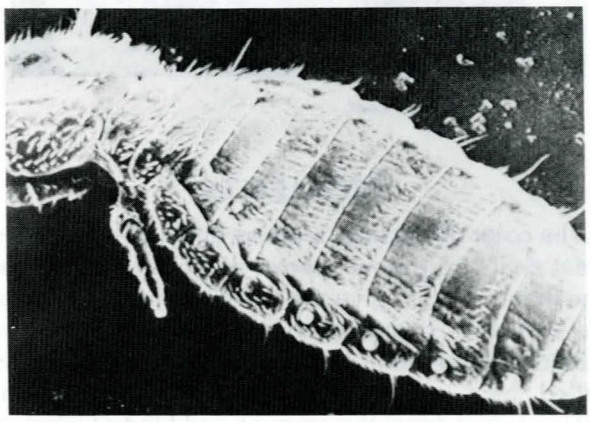
ABNORMAL SKIN

Skin abnormalities can frequently, but not always, be seen at a distance. They include changes in the hair, wool or feathers, abnormal sweating, the presence of sores or wounds, evidence of soiling by excretions and itching. It is important to check your animals often for external parasites, cuts and scratches which could cause infection and itching if neglected.

Skin infections in animals can result from filthy surroundings and negligent owners. Ringworm is an example of a skin disease which can be controlled by good hygiene (to keep clean and sanitary). It can spread from infected animals and living quarters to non-infected animals by direct contact, or may be transmitted by curry combs, brushes or rubbing on objects that have been in contact with the ringworm.

There are many other conditions that can cause the skin and hair to have an abnormal appearance, but the most important thing is to first recognize the fact that there is something wrong, and then, find the cause or get help in finding its cause.

Many other things can cause skin and hair problems. Some of these are nutritional deficiencies (shortages in the diet), chemical irritants, skin infections, freezing, sunburn, trauma (bruising), and external parasites such as mites and lice.



2.3 A common louse - 20 times actual size.

MUCOUS MEMBRANES

The mucous membranes of animals line the eyelids, nostrils, mouth and other natural body openings as well as the digestive tract, and respiratory passages. They are a form of protection for your animal. These membranes are pinkish in color, due to blood flow close to the surface, and should be moist if they are healthy. By close observation, an experienced person can tell a great deal from mucous membrane color. Abnormal color may indicate many things, including anemia or possibly shock conditions from severe diseases or injury. Anemia is a very complicated condition. The most important thing to remember is, if you notice a change in mucous membrane color, contact a professional for help. These conditions are very important in comparing the normal to abnormal, as steps can be made to reverse a life and death situation.

Normally, the mucous membranes of some animals are without pigment and appear pink. In some breeds, such as the Chow dog and the Hampshire sheep, the mucous membranes are pigmented black. In this case, the inner surface of the eyelids and the whites of the eyes are good signs of the condition of the mucous membranes. Abnormal odor or drainage from mucous membranes are signs of an animal's health.

2.4 Brown Swiss cow - Black pigmented muzzle.

A healthy animal will usually clean up its own mucous membranes in various ways, as a cat does by rubbing with the paw across the nose or eyes. If, however, an animal neglects this cleanliness, it is likely there is something wrong with the animal. Occasionally, even a healthy animal has problems cleaning a certain area. If this occurs, it is a good idea to aid it with a soft moist sponge, cloth or comb.

FOOD INGESTION AND INTESTINAL DISCHARGES

In all animals, including humans, some food taken into the body passes out as a waste product called the feces (fee-sees). Feces (intestinal discharge) are also referred to as manure, stools or droppings. The process of eliminating these waste products from the body is called defecation (deaf-e-kay-shun). Because of the differences in size and structure of the intestinal tract of animals, the consistency (thickness or firmness), color and amount of feces varies with the species of animal and its diet.

The food ingested (taken in) by an animal enters the mouth and is moved through the *alimentary canal*. The alimentary canal is the tubular passage that extends from the mouth to the anus. Its function is to digest food, absorb nutrients and eliminate the remaining food waste.

It is extremely important to be familiar with how an animal normally eats. Abnormal eating habits are signs that may be important for determining if the animal is sick or well.

It is also very important to know the normal color, consistency and amount of fecal material excreted by a certain animal. Feces that are watery, scanty, bloody or off-color, are signs of various disease processes that must be well understood to aid in correct diagnosis.

One of the most obvious changes in the fecal consistency is the frequent passage of profuse (a lot), watery feces (diarrhea). It may be the only sign of a disease or it may be a single sign in a more complex disease. Just as important as a health indicator is the sudden stopping of the production of feces or of a decreased amount of very dry feces. Remember, we must compare with the normal.

THE SKIN, MEMBRANES AND INTESTINAL DISCHARGES

Member Activity: Complete the following information about the reading material and your animal. Read through the following statements quickly and check whether you agree (A) or disagree (D).

		A	D
1.	The skin and coat are important indicators of animal health.	____	____
2.	The thickness of the skin varies from one part of the body to another	____	____
3.	It is not necessary to check the mucous membranes for signs of ill health	____	____
4.	The blood is closer to the surface in the mucous membranes than on skin surfaces.	____	____

5. Define the following terms:

a. skin _____

_____

_____

_____

b. coat _____

_____

_____

_____

c. pigment _____

_____

_____

_____

d. mucous membrane _____

_____

_____

_____

e. feces _____

_____

_____

_____

6. Examine and observe your animal and complete the list:

   a) Condition of coat

   b) Any abnormalities in coat

   c) Color of the skin

   d) Condition of the skin

   e) Condition of feces (include consistency, odor, amount)

   f) Condition and color of mucous membranes

7. What are the areas on your animal where the skin is loose?

8. How do pigments cause variations in colors?

9. What are some examples and causes of skin abnormalities?

10. Where are mucous membranes located? What are their jobs?

11. What is the significance of diarrhea?

12. What are three changes you should watch for in feces?

Extra Activities:

A. Describe the course food takes in your animal, naming the various parts it passes through.

B. Check the feces of your animal for parasites with the aid of a veterinarian. If any are found, list what can be done about them and the steps you are going to take.

Unit I, Lesson III

BODY TEMPERATURE, PULSE AND RESPIRATION RATE

Words to Know:

pulse: the beating of the heart while pumping the blood causes waves in the arteries that can be felt.

respiration: the act of breathing by which animals take in air, use oxygen and release carbon dioxide.

artery: any of the blood vessels which carry blood away from the heart.

After reading this section you should be able to answer the following questions:

- What are some factors that can cause temperature, pulse and respiration rates to be different from one animal to another and even from hour to hour?
- What is the pulse?
- Where should you take the pulse in your animal?
- Explain the terms inspiration and expiration. Define respiration rate.
- How do you count the respiration rate?
- Why is it important to take your animal's temperature, pulse and respiration rate **all** into account, instead of just relying on one of those?

BODY TEMPERATURE, PULSE AND RESPIRATION RATE

The body temperature recorded on a thermometer is sometimes an excellent indicator of the general health of your animal. Because the temperature is not always the same in all parts of the body or even constant in one particular place, the rectal temperature is used to show the internal temperature of the body. If, for example, you take an animal's mouth temperature, you will find that the mouth reading is lower than that of the skin, which may be much lower than the rectum, where most animal temperatures are taken.

For animal use, it is best to have a clinical thermometer of heavier construction than the fragile types used by physicians. These thermometers are available from your local veterinarian or drug store, and can be a valuable guide for *early* detection of disease. Usually there is no need to check your animal's temperature unless you see other signs that indicate your animal may be sick. However, a normal temperature does not always indicate a healthy animal. If you get a normal reading, but still see other signs of abnormality, consult your veterinarian.

USE OF A THERMOMETER

To be sure of an accurate reading, shake down the mercury before insertion. Do this by holding the thermometer near the end between the first two fingers and the thumb with the mercury or bulb end away from clothing. Snap it quickly as if you were snapping a whip. The mercury should drop one or two degrees with each snap.

3.1 Hot sunlight or water intake sometimes influence body temperature.

To take the temperature in most animals, moisten or lubricate the bulb of the thermometer with Vaseline or a similar jelly and place it, full length, into the rectum. Remember, before you attempt this to consult your veterinarian for instructions on the proper method of insertion for your particular animal. Be careful when doing this, as a few animals may kick or bite. After inserting the thermometer into the rectum, hold it in place for at least two or three minutes, then withdraw, clean, and read the thermometer at the top of the column of mercury. Seek assistance from your leader if you cannot see the reading.

Some animals will require a special measure to hold them while you are taking their temperature, be cautious but, be gentle and firm.

It is not possible to give exact figures for temperatures of different animals under normal rest conditions as they vary. Therefore, the figures in the following table are general, but usually do not change more than a degree in either way.

Horse	100.0°F	(37.7°C)
Cow	101.0°F	(38.3°C)
Pig	102.5°F	(39.2°C)
Sheep	102.3°F	(39.1°C)
Dog	102.0°F	(38.9°C)
Cat	101.5°F	(38.6°C)
Chicken	107°F	(41.7°C)

TEMPERATURE VARIATIONS

There are several factors influencing body temperature in a healthy animal. Some of these are weather, exercise, disease and excitement. Excessive exposure to direct sunlight may cause a slight rise in temperature, while drinking large amounts of cold water or being exposed to cold winds will cause the temperature to fall temporarily. Usually one or two hours after a meal, the body temperature is a little higher. You will also notice an increase when the animal is nervous or emotionally high-strung. Animals being handled excessively and under stress during a show will also show a rise in temperature.

You may also notice that the time of day affects temperature readings. The temperature is usually 1/2 to 1 degree higher in the late afternoon than in the morning. In man, the highest temperature occurs in the late afternoon and is the lowest in the morning, because the body has been at rest. In cows, the temperature is about the same until around 2:30 p.m. From then until 5 p.m., it gradually rises 1/2 to 1 degree. These changes are normal and do not indicate disease.

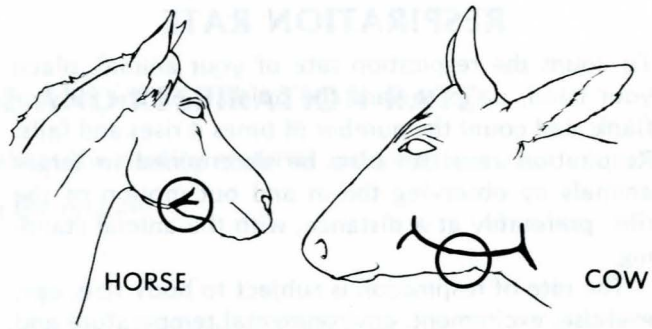
If you notice a rise in temperature, do not immediately assume that it means, disease or sickness. Sex, age, season, temperature, temperament (nervous or calm), mating and digestion have an affect on temperature rise and fall. If your animal is small or quite young, it will have a tendency to have a higher temperature than older and large animals. Be sure to take all the above things into account before assuming something is wrong with your animal. But if you are still concerned, consult your veterinarian.

THE PULSE AND HEART RATE

The pulse, which you can feel on the inside of your wrist, is an intermittent blood pressure surge in an artery. It is caused by the heart forcing blood into the arteries and by the widening and closing of the elastic artery wall. This alternate (first one, then the other) stretching and contracting passes along the wall of the artery at the rate of 25 feet (7.5 m) per second in man. Blood itself inside the artery flows at a much slower rate, about 20 inches (50.8 cm) per second. To explain it in other words, what you feel as a pulse is blood surging through the artery because of pressure the heart puts on it when it beats.

To take the pulse in a horse, locate the margin of the jaw where the artery winds around from the inner side. Other arteries, close enough to the skin to be easily felt, are located on the inside of the elbow of the front leg and under the tail. The cow's pulse is taken on the outside of the jaw, just above its lower border. If you are unable to feel the pulse, simply feel or listen to the heart beat as its beat is equal to pulse rate.

Heart rates are taken for a time span of a minute. Because of the rapid rate of the heart beat in many animals, it may be difficult to count the number of beats for a full minute. As a rule, smaller animals have a faster heart rate or pulse than do larger animals.



3.2 **Areas where pulse can be taken.**

The heart rate of a mouse, for example, is about 600 beats per minute; guinea pig, 280; and elephant, 30. Even in the same species of animal, for example a small dog such as the Chihuahua may have a heart rate of 120 beats per minute while a German Shepherd or Great Dane may average only 80 beats per minute or less.

Both veterinarians and human doctors attach importance to the character of the pulse, such as the force and fullness of the beat, and form of the pressure wave. A beat may be quick and short and long, slow or soft, while at other times it may be fast, thin, thready and irregular. A healthy horse and cow usually have a steady rhythm while the dog may have irregularity (uneveness) in the rhythm of the pulse.

The normal pulse rate of the different adult animals is listed below. Remember that these are only average and if your animal differs somewhat in either way, do not consider it abnormal. Also remember that just as other factors affect your animal's temperature, they may also affect its pulse.

Horse	30-34	Pig	60-80
Cattle	60-70	Dog	70-120
Sheep	70-80	Cat	110-130
Goat	70-80	Fowl	200-400

BREATHING OR RESPIRATION RATE

Breathing is to draw air into the lungs (inspiration) and expel it from the lungs (expiration). The respiration rate is the number of times per minute that air is inhaled and exhaled. When animals breathe, air flows into the lungs, which lie freely in the thoracic (chest) cavity. Increasing the size of the rib and chest cavity results in the expansion of the lungs, due to air pressure within them, and the inspiration of air through the nostrils or mouth. Air is exhaled from the lungs by the contraction of the thoracic wall and the action of the diaphragm, a flat muscle that aids in the breathing process.

HOW TO COUNT RESPIRATION RATE

To count the respiration rate of your animal, place your hand, palm toward the animal, on the ribs or flank, and count the number of times it rises and falls. Respiration rate can also be determined in larger animals by observing the in and out motion of the ribs, preferably at a distance, with the animal standing.

The rate of respiration is subject to body size, age, exercise, excitement, environmental temperature and the degree of fullness of the digestive tract. Fat show animals may have a respiration rate twice that of a thinner animal. Injury or disease may also cause changes in the respiration rate, temperature and pulse.

The respiration rate varies from one species to another within certain limits as seen in the following table. Once again, remember these are average rates and your animal may vary in either direction.

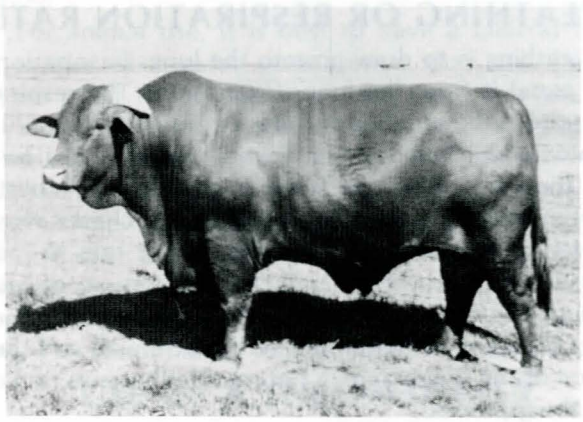
Horse	8-16	Pig	8-18
Cattle	10-30	Dog	10-30
Sheep	12-20	Cat	20-30
Goat	12-20	Fowl	15-30

EFFECTS OF HOT AND COLD TEMPERATURES

During hot weather months, you will notice your animal consumes large amounts of water. This can also happen following exercise, as more heat is created from the increased activity. The intake of water is important in prevention of dehydration and regulating body temperature.

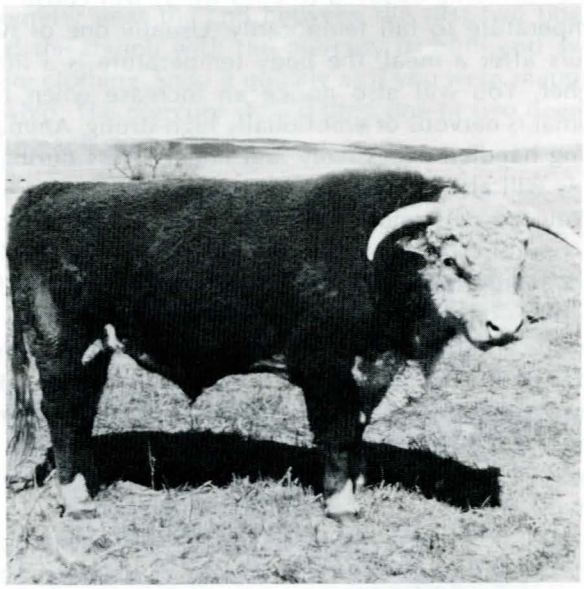
An animal adjusts in several ways to temperature changes. If the winter season is approaching, a heavier hair coat is grown to aid in maintaining body heat and, on the other hand, shedding of hair occurs when the warm seasons approach.

Some individuals within a species show characteristics of heat adaptation. In cattle for example, the Brahma is nearly hairless, while the Galloway has a very long and thick hair coat.



3.3 **This bull is adapted for hot climates.**

Some animals are able to adapt to hot or cold easier than others. Their family origins or genetic make-up equip them with this ability. Some animals pant to reduce overheating, some cool themselves by evaporation of sweat on the surface, others just lie quietly on hot days to reduce heat generation.



3.4 **This bull is adapted for cooler climates.**

In the very cold season, the hair coat insulation is only a part of the temperature regulation. Foods that are eaten have a great bearing on animal body heat, as some foods have large amounts of energy to be released as heat, while other feeds have little. Whether the temperature is very cold or hot, good, clean water available at all times (free choice) is important in maintaining proper body temperature.

As you can see, the body has many clues which may indicate to the watchful owner the physical condition of the animal. You must not depend only upon the respiration rate or the pulse to tell you how healthy your animal is; use the respiration rate, pulse, temperature and many other observations together. This is important to remember, as in some diseases the temperature of the animal remains normal, but the pulse or respiration may increase rapidly. It is unnecessary to check the pulse, respiration and temperature unless you feel your animal is not acting well. Veterinary assistance may be necessary to interpret abnormal variations of any kind that you may observe.

BODY TEMPERATURE, PULSE AND RESPIRATION RATE

Member Activity: Complete the following information about the reading material and your animal.

1. Why should you take your animal's temperature in the rectum?

2. List four factors that may influence the body temperature in a healthy animal.

3. List any times your animal had a fever and what caused it.

4. Explain in your own words what causes the pulse.

5. Where do you take the pulse on your animal?

6. What would you expect the temperature of your animal to be?

7. What would you expect the pulse of your animal to be?

8. What would you expect the respiration rate of your animal to be?

9. Describe the methods you use to determine the body temperature, pulse and respiration rate of your animal.

10. What is your animal's: _____ Temperature
_____ Pulse
_____ Respiration rate

Extra Activities:

A. Make a chart showing the daily temperature of your animal for four weeks. Note why you think there are any changes.

B. Look up more on your animal's respiratory system. Describe the process of respiration and what the various organs of the body do to aid respiration.

Record of Food and Water Consumption

Hot Day Cold Day

Food: _____

Grain: _____

Hay: _____

Water: _____

Unit I, Lesson IV

MAINTAINING ANIMAL HEALTH

Words to Know:

antibodies: these are small elements in the blood that neutralize disease-causing agents in the body. Antibodies can be built up by giving vaccinations or recovering from a disease.

contagious: anything which can be spread by contact from one animal or person to another. For example, chicken pox is contagious because if you are around a person who has it, you may get it later.

immunity: ability to fight and resist disease.

immunization: to protect against disease by giving antigens for that disease (vaccination).

incubation: the time during which the disease can develop after an animal has been exposed.

nutrients: food that gives animals what they need to live and grow. The process where the animal takes in the food and uses (assimilates) it is called nutrition

resistance: the ability to fight off something, in this case, disease. Resistance can be built up by many things, such as eating, resting and exercising properly as well as by vaccinations.

vaccine: a substance used to stimulate an animal or human to build up resistance to a disease. A vaccine contains antigens to stimulate the animal to make antibodies.

After reading this section you should be able to answer the following questions:

- Why should your animal be kept healthy?
- Explain what is meant by adequate housing, why it is important and list some factors which should be considered when choosing and locating housing for your animal.
- List and explain the other 5 management steps.
- What is meant by a balanced diet? Give reasons why a balanced diet is important.
- Describe what is the most economical and successful way to handle animal diseases and parasites.

MAINTAINING ANIMAL HEALTH

If someone were to ask why your animal should be kept healthy, you might answer that the animal feels better, does its best work, or gains weight properly when it's healthy. You might add that to keep your animal healthy, you must practice good management of proper feeding, disease prevention and parasite control.

But how many animal owners really know how much or what kind of feed to give to keep an animal in good health? Did you know that keeping your animal well is not only for its physical comfort, but for the protection of other animals, and even other people? Let's look back a few years and see why good animal husbandry is so necessary.

DISEASE - AN OLD PROBLEM

Since animals have been on this earth there have been disease problems that involved some of them. For an animal to survive the many types of diseases it is exposed to is truly remarkable. Within the system of every normal animal there is a mechanism that has the ability to fight disease. This complex mechanism can build defenses (immunity) against nearly any disease. It is this immunity that keeps most animals healthy, many times protecting them even if there has been no evidence of being sick from the disease before. When an animal recovers from a disease this immunity is usually responsible for the recovery. This is not to imply that medicines are not of help because they do help in keeping the animal alive while it is building immunity.

Disease spread today is more common because animals are more easily moved from place to place and frequently are kept close together in large numbers. Exposure is such that some animals become sick and will die if the immunity does not build up fast enough. The use of medicine in treating the sick animal is helping Mother Nature to have time to build this immunity.

4.1 Large numbers close together can spread diseases.

By keeping your animal healthy, the ability for it to build immunity will be improved and because of your management and care, it can protect itself faster and better.

There has been a lot learned about diseases. There have been vaccines and medicines developed that help prevent and cure the problem in many cases. However, there are no effective treatments for some diseases. Research scientists, veterinarians, and government agencies recognize the problems, and work to control diseases in many ways. Some of the animal diseases can also infect people.

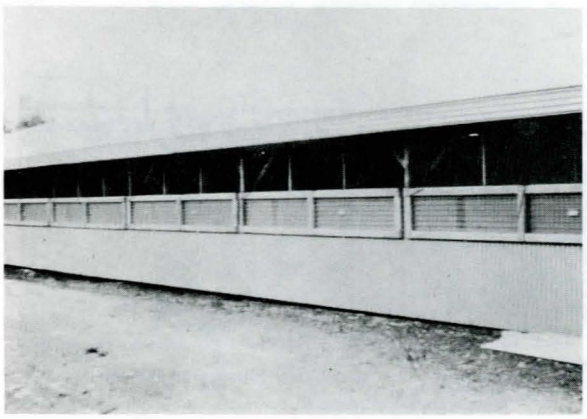
There are many degrees of ill-health, varying from a mild abnormality, such as a minor skin disease, to serious damage to an important part that may cause death of the animal. Although there is no known way for completely eliminating every disease known, researchers have made great strides in preventing, controlling and eliminating most diseases. However, to prevent disease or the spread of it to your animal, you must practice and understand the rules of good animal and health management. It has been estimated that at least three-fourths of the losses from death and lowered production could have been prevented if known health practices were followed.

ANIMAL MANAGEMENT STEPS

- Provide Adequate Housing

Housing for animals is necessary to insure their well being and comfort. Some need protection from other animals that would feed on them. Adequate housing also shelters against harmful weather. This aids in reducing stress (over-exposure) type diseases. All newly born creatures should be kept from chilling and adult animals may need protection when the weather is severe. Adequate drainage is necessary in the corrals to allow the ground to dry rapidly after a wet spell. Long periods of wet and muddy conditions encourage disease development.

Although housing is desirable for all animals, constant confinement can also be dangerous, especially if ventilation and cleaning techniques are poor.



4.2 Desirable, well ventilated housing.

Each animal's need for living quarters is different and should be studied thoroughly. Because of the vast amount of information available on every facet of housing, only the basic facts which apply to most animals will be discussed here.

Location: Animal buildings should be placed at a lower level and far enough away from human dwellings to avoid the flow of barnyard waste toward the human quarters. Each group of buildings should be on high, well-drained ground. All waste material should be removed regularly and spread in the sun, or unused animal pastures. Failure to do this could result in high numbers of parasite eggs or bacteria which can infect your animals.

Buildings which face the north are usually cooler and, due to infrequent sunlight, usually damp. A southern or eastern exposure is preferable. Be sure that good ventilation is available in all living quarters and that dust from hay lofts is not permitted to infiltrate (filter in) the air that your animal breathes.

The size of the living quarters varies with the species needs, disposition and sex of each animal. Information about the construction, material and requirements of each species should be obtained from your 4-H leader, county agent, veterinarian or library. Vast improvement in the design of housing has been made by many agricultural colleges in past years. Literature about these advances can help you learn to practice good management and keep your animal's living quarters sanitary and practical.

Remember, most animals need a large, clean, dry area in which to live. It should be free of drafts, sharp nails and edges, free of filthy or wet bedding, and warm during the cold months. When providing good housing, quality bedding is very important as it provides insulation, comfort and has the ability to absorb moisture. If breeding of animals is part of your 4-H project, you will need additional information on how to care for them and what additional space is needed for each type project.

- Provide Adequate Sunlight and Exercise

Sunlight is necessary for all animals to function properly. Certain feed necessities are not absorbed if sunlight is not present. The absence of direct sunlight may result in the nutritional-deficiency disease termed rickets.

Exercise is necessary for every animal, regardless of the time of year. All animals should be turned out for a period of time every day for exercise, even if it means extra work for you.

Exercise tones up flabby muscles, gets the blood circulating and energizes the animal. It also helps keep them from getting overly fat. Exercise is as important for animals as for humans.

- Keep Animals Well Groomed

Clean animals are naturally more comfortable and less liable to spread infection or parasites to others around them. Good grooming frees the coat and skin

of dirt and dandruff. It stimulates blood circulation and cuts down the chance of serious skin diseases. While grooming your animal, you will also have the chance to examine the skin for superficial (surface) cuts and bruises. Daily grooming will enable you to keep a closer check on its health.

4.3 **Sunlight and exercise helps maintain health.**

- Pasture and Premises

Eliminate marshy areas and stagnant water by draining or fencing. If manure deposits are heavy, harrow the pastures to scatter the manure so it will soak into the ground after a rain. Animals living on unsanitary or unclean areas are more likely to acquire parasites and disease. Manure often contains disease producing elements. This waste, if left around living quarters, could lead to mass contamination. Animals living in unhealthy surroundings are examples of poor animal management by the owner.

- Prevent Injury

Careful, regular inspection of pasture fences, pasture land and all enclosures that your animal lives in are necessary as a health precaution. Check the pasture for wire, debris, and poisonous plants. Check fences to eliminate protruding nails, sharp edges, splinters and sharp wires. Look for nails and wires on the floor; unsanitary bedding which could cause foot and limb infection; and concrete abutments which could cause stumbling or physical injury. Nearly all injuries the veterinarian treats can be traced to something a person has done or neglected to do.

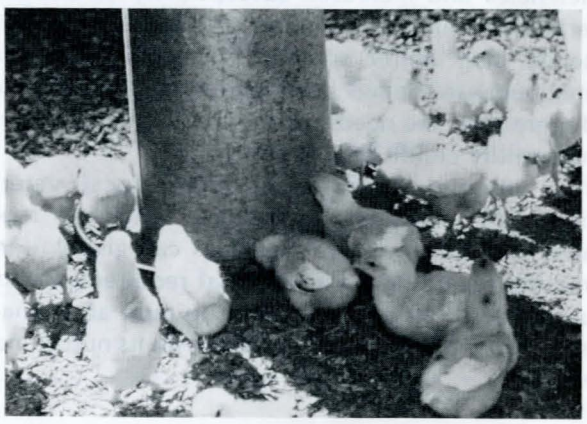
4.4 **Correct hazardous areas that may cause animal injury.**

- Keep Eating Utensils Clean

Daily exposure to sunlight will kill most harmful bacteria in your animal's water container or pail. Regular cleaning of the trough or water tank will also help control or eliminate most infectious agents. A fresh, clean, abundant water supply is a must at all times. Keep pasture water and equipment as clean as possible.

PROPER FEEDING

Feeding your animal every day is something you do automatically, without really thinking about the effect food has upon him. With each scoop of grain or spoonful of meat and cereal, you are giving your animal the energy to move and play; the vitamins and minerals to keep healthy; and the "building blocks" of protein to grow. Animals need these energy sources for body maintenance, growing, fattening and production of milk.

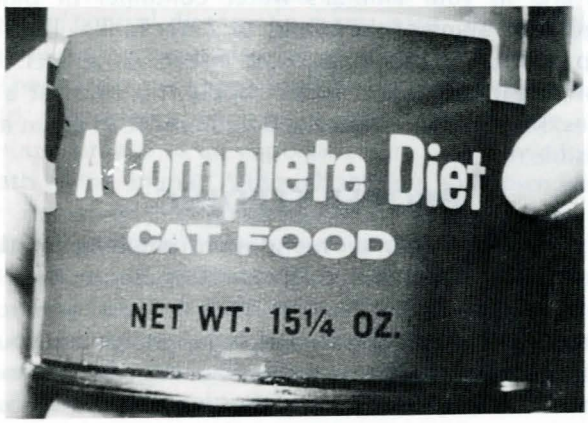


4.5 **Proper feeding is essential for health and growth.**

Providing nutrients for your animal makes you a part of the world of animal nutrition. The feed you give your animal is composed of many combinations of chemical substances. After the food is eaten, more digestive fluids are added to it by the animal's body. These added materials cause reactions which break the food down into small pieces, invisible to the naked eye. These tiny pieces are then taken into the blood stream and carried to all parts of the body. Here, they are "burned" as energy, form body tissue or are stored as energy in the form of fat.

You can now see why it is so important to give your animal a balanced diet. A balanced diet includes the right amount of every vitamin and mineral it needs to stay healthy. Some diseases are caused by deficiencies (shortages) of certain nutrients. Feed deficiencies

can cause body abnormalities, infertility, abortion and other disturbances. Animals have more disease resistance if their rations are adequate. The better the nutrition, the better equipped the body is to handle and resist disease. It is wise to remember that the best nutrition does not necessarily mean the most fattening ration. It is not always necessary to buy extra vitamins and minerals because these items are frequently already present in quality feed.



4.6 All animals should have a balanced diet.

Rations can also cause health problems other than deficiencies and increased susceptibility to disease. Overfeeding can cause founder and bloat. An overly fattened beef heifer sometimes becomes infertile simply because she has been fed an unbalanced feed and more than she needs. Her reproductive tract is in an unhealthy condition.

Your libraries, breed associations, local veterinarians, 4-H leaders, agriculture teachers, feed dealers, and governmental agencies can give you information regarding the nutritional requirements for your animals. Before you attempt to raise an animal, be sure you are thoroughly familiar with its nutritional needs.

DISEASE PREVENTION AND CONTROL

Even with the tremendous strides in disease control and prevention, veterinarians sometimes find that they cannot cure a diseased animal. In many of the cases, they find that the animal has been brought to them too late and the disease is beyond control. This is where you can help your animal and get better veterinary results. You must constantly check on the health of the animal and seek professional help at the first sign of any disease lasting longer than one day. Call immediately if the animal is critically ill.

The most economical and successful way to handle animal diseases and parasites is to prevent their introduction and spread. Some important steps in preventing and controlling animal diseases and parasites are listed.

- Keep the Animal's Resistance High by Health Management

The ability of an animal to fight off an infection is known as resistance. This can be kept at a healthy level with the aid of a planned program. Resistance is based on good animal management and proper feeding, plus vaccination against diseases. If you are careful about the care and feeding of your animal, you are helping it maintain its resistance. The most necessary and important part of a program like this is planned immunization. To immunize an animal is to help it to guard against diseases by building up antibodies or immunity. Anti means against, therefore, the antibodies in your animal's blood are small elements that work against diseases.

Contagious diseases are caused by tiny, invisible microorganisms, most of which are bacteria and viruses. To fight off infection before it has the power to kill, veterinarians vaccinate animals with a vaccine. A vaccine has a substance called an antigen which stimulates the body to produce antibodies against the virus. A vaccine has the ability to build immunity without causing the disease itself. Vaccination should take place before an animal is exposed to a disease. If it happens after disease is present, the animal will not have time to build its defenses. Death or prolonged disease could occur.

Planning a total immunization program with your veterinarian is the most scientific way to prevent the diseases for which there are vaccines. Remember that all the planning you do is not going to be effective if you do not follow through with the program. Unless the animal is actually vaccinated on time, with the right vaccine and by the best method, immunity will not be achieved.

- Keep Visitors and Other Animals Away

Diseases are transmitted in many ways. They may be carried on the boots, shoes and clothing of people or by the feet, hair, feathers and feces of birds and other animals. As the traffic in and out of your animal's quarters is reduced, so are the chances of transmitting disease. Not only can disease be carried in, it can also be carried out. Remember that your

4.7 Cleanliness will reduce disease transmission.

responsibility as an animal owner is not just to prevent disease of your own animals, but also that of others. Disinfection of clothing and footwear when attending your own and visiting others, will help decrease disease transmission.

- Quarantine Your New Arrivals

One way diseases are carried is close association or direct contact of animals. Infected animals coming into a herd could transmit a disease to the entire herd. Animals that you plan to add to a herd or flock should be isolated (kept apart from others) for three to four weeks. Isolation for a period of time helps prevent disease outbreaks by restricting the disease to only the new animals. This applies to new animals and to those who were part of a herd, but have been taken away and exposed to other animals, at a fair or show, for example.

The incubation period or the time between exposure and signs of the disease to appear is usually less than 30 days. If animals do not break with a disease in three or four weeks of isolation, chances are they are free of highly contagious diseases. Isolation will also give you a chance to observe the new animals for signs of disease and/or abnormal behavior. Isolation not only protects your herd or flock from transmissible diseases, but from infection by internal or external parasites. It also gives them a chance to adjust to new surroundings.

It is also recommended to isolate an animal when illness appears. Precaution at this early stage may save the animal and guard the health of others. Isolation of younger animals from older ones is a necessity if you own more than two or three animals. Larger animals may seriously injure or crowd smaller ones away from feed if they are housed together.

Examination of each new animal by a veterinarian is a wise idea. He will be able to tell you if the animal is abnormal in any way and advise you as to its care and feeding. This examination will enable you to have the new animal vaccinated, examined for external and internal parasites, and have a general physical exam at the same time.

MAINTAINING ANIMAL HEALTH

Member Activity: Complete the following information about the reading material and your animal.

1. Name 3 things necessary to maintain animal health.

2. What is the most economical way to handle the disease and parasite problem? Why?

3. Explain what resistance and immunity are.

4. Describe your animal's housing. Do you feel it needs changes to be more adequate? If so, explain how.

5. List how your animal can get the sunlight and exercise it needs.

6. Explain why grooming is important to maintaining an animal's health.

7. Are there any danger spots you know of which could injure your animal? What will you do about them?

8. How do you keep feeding and watering equipment clean?

9. How do you practice disease prevention?

Extra Activity:

A. Make a chart of what percentage of vitamins and minerals your animal's feed has. Compare it with other types of feed.

Unit I, Lesson V

CLEANING AND DISINFECTION

Words to Know:

disinfect: to kill disease germs by using a chemical agent that destroys the bacteria. Different from cleaning in that the removal of excess debris is so important for disinfection to kill germs.

organic matter: generally considered to originate from plants or animals. Blood, milk, pus, and fecal material are all examples of organic matter. These things reduce the killing power of disinfectants.

After reading this section you should be able to answer the following questions:

- Explain the difference between cleaning and disinfection.
- Name three instances in which cleanliness is important and tell why.
- Why is it important to clean before using disinfectants?

CLEANING AND DISINFECTION

Disease is a primary killer and crippler of animals. The microorganisms that cause diseases are present in the living quarters and pastures of your animal and even in the surrounding countryside that you may sometimes walk through. Germs may pass from an infected animal to a healthy animal through discharges from the intestine or from body lesions (open wounds). Certain diseases may be transmitted by insect bites. Encephalitis or sleeping sickness is an example of a disease that can be transmitted from animal to man, primarily through the mosquito that has bitten the animal and then later the man.

More than 100 years ago, the well-known scientists Pasteur, Koch and Lister demonstrated that diseases are transmitted by germs. In this 4-H project, you will be practicing some of the measures recommended to keep your animal healthy, by stopping the growth of these germs and keeping them from being carried to other animals and people.

CLEANING PROCEDURES

The first requirement for maintaining health is cleanliness. Cleanliness begins with germ-free, spotless living quarters and sanitary feeding and watering equipment. Feeding and watering equipment may feel and look clean, but bacteria may still live on it. Exposure to sunlight will destroy most bacteria, therefore you should make a habit of scrubbing and sun drying pails, buckets and other equipment. This is best done each morning after animals are fed and watered.

Cleanliness should also be considered in transporting a newly purchased animal. The truck or trailer used for transport should be scrubbed before loading the animal. Cages and pens for moving smaller animals should receive the same treatment. Before moving the new animal into its permanent quarters, change all bedding and thoroughly clean and disinfect the formerly occupied stall, pen or cage. If the floor of the living quarters has a covering of dirt, rock or gravel, remove it to a depth of three inches (7.6 cm) and replace with a fresh covering. A pen with a concrete floor should be thoroughly cleaned and disinfected before being used by the new animal. Proper preventive measures will lessen the chances that your new animal will become infected or diseased from another animal.

Before attempting to water, feed or groom the new animal, make sure that utensils have been cleaned and disinfected. Just as you avoid using another's toothbrush or comb, you should also avoid using your equipment on other people's animals. Lice, body parasites and other disease carrying organisms may be present on feeding or grooming equipment and even though invisible, can infect the new animal.

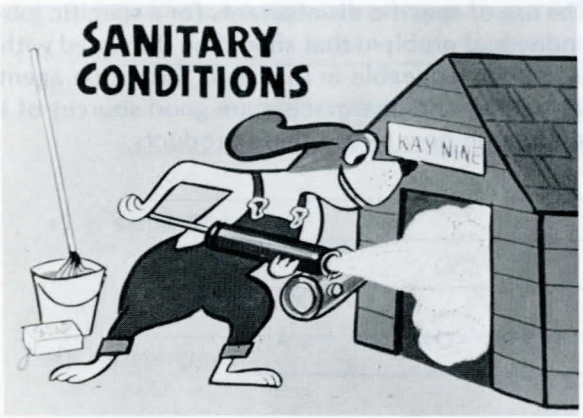
CLEANING AND DISINFECTION

The terms cleaning and disinfecting have been used together in this lesson and although they are really two separate functions, are often considered as one. To clean means the removal of dirt, which is usually done with a broom, brush or shovel. A strong detergent or soap may be used to scrub out buckets or grooming equipment to keep them clean (free from obvious dirt). Even though they look and feel clean,

5.1 Dirty areas are cleaned, but this does not kill bacteria.

there are microscopic (invisible to the naked eye) organisms present.

To disinfect, you use a chemical or agent that destroys these bacteria and other infectious agents. When chemicals are used to destroy germs, the process is referred to as disinfection. Although many types of disinfectants are applied in the same way as cleaning, the solution is much stronger than soap and may be harmful to the skin. Rubber gloves should be used and, with some disinfectants, you should avoid breathing the fumes. You might spray a barn with a hose and think it is clean because the dirt has been removed. You know that it is clean and free from most bacteria and infectious organisms after applying a disinfectant.



5.2 **Disinfecting kills bacteria.**

Disinfection of living quarters will make the animal's environment reasonably sanitary, but will not eliminate disease if an animal is already infected. To carry out a health program, you must make sure the animal and its quarters are both disease-free.

GENERAL RULES FOR USING DISINFECTANTS

- Thorough cleaning is needed in advance since organic matter (such as manure) serves to protect disease germs and interfere with the activity of disinfectants. Particles of blood, milk, semen, pus, fecal material and some soils are organic material that will protect the germs against the killing properties of a disinfectant. Even strong disinfectants may not be able to penetrate the organic coating to reach germs. Disinfectants kill germs by reacting with the proteins and enzymes of the germs.

Cleaning can be done with a shovel and broom or can be speeded up by use of high pressure pumps and detergents, or with a steam cleaner and detergent. Detergents hasten dirt removal by increasing the wetting spread (ability to soak in) and by breaking up the organic material into small particles. Remember that it is important to first **clean** the area to give the disinfectants a better chance to do their job.

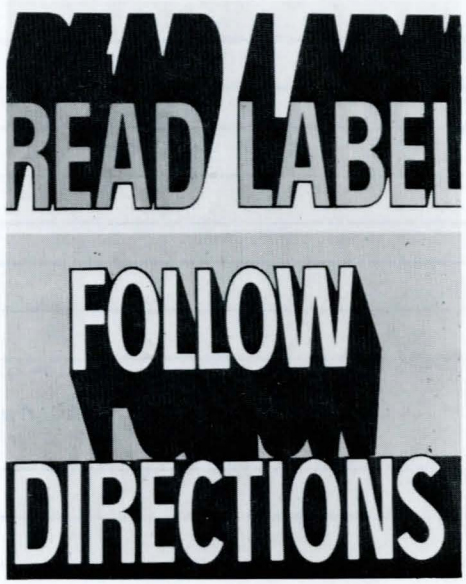
- Apply disinfectants warm or hot. Heat favors greater penetration and permits better coverage.
- Allow 6 to 10 hours for the disinfectant to act.
- For economy and efficiency, apply a sufficient quantity with enough force, as in a pressure pump, to cover the entire surface and penetrate into all cracks and crevices.

Often, the term sanitation is substituted or used instead of the term disinfection. Sanitation means the process of making sanitary by cleaning. This cleaning process will reduce the number of bacteria. A disinfectant does not mean a cleaning process.

The correct formula for disinfection is:
MECHANICAL CLEANING + DETERGENT + GOOD DISINFECTANT = PROPER DISINFECTION.

DISINFECTANTS

There are various types of disinfectants. Some are better to use on one type of job than another. If there is a need to disinfect the skin, this of course, must be mild enough to not irritate the tissue, but strong enough to still kill the surface organisms. To disinfect living areas, a different, more caustic (will burn) type can be used.



5.3 **Always read label carefully, and follow the directions.**

Regardless of the type of disinfectant, you must handle with care and follow instructions on the container **exactly** as recommended by the manufacturer, as all are potentially dangerous. Don't use more than directed on the package thinking that it will work better. The manufacturers of the product have carefully checked and tested the best and safest way for you to use this product. You must follow these directions to get the best results.

Some types of disinfectants and their use are:

- **Hot Lye Solution.** Lye is an effective solution for use in disinfecting farrowing pens, stalls and buildings. It will kill most bacteria and viruses. Since lye is very caustic, it is advisable to wear rubber gloves,

overshoes and goggles. It will not damage bare wood, earthenware, enamelware or any of the common metals except aluminum. One 13-1/2 ounce (405 ml) can of lye should be added to 5 gallons (19 l) of hot water to make a 2 percent solution. Smaller quantities of the disinfectant, suitable for cages and equipment, are made with 6 tablespoons (90 ml) of lye to 1 gallon (3.8 l) of water.

If accidentally applied to skin, wash immediately with large amounts of water.

Wherever lye is used, remember to wash down all surfaces with clean water to remove excess lye.

- **Quaternary Ammonium Compound.** These compounds lower the surface tension of liquids and belong to the group of chemicals called wetting agents. They are effective for use in disinfecting instruments, but are not recommended for general use in cleaning buildings and equipment. These compounds are made inactive by organic material. They are neutralized (weakened) by soaps, so the surface to be disinfected should be rinsed before the compounds are used. They are very effective deodorizers.
- **Detergent-Sanitizers.** Detergent-sanitizers (cleaning-sanitizers) are formulations which combine a cleaner and disinfection in one step. They have excellent cleaning properties, perform well in either soft or hard water and are effective in the presence of moderate amounts of organic matter.
- **Iodine.** Tincture of iodine, 2 percent in 70 percent alcohol, is one of the most effective skin disinfectants. It is recommended for use on the navel of newborn pigs. Stronger tinctures tend to dry quickly and unevenly, leaving streaks of concentrated iodine that will burn the tissues and delay healing. Some improved iodine preparations are now available that are effective against bacteria and fungi and are not irritating, corrosive, odorous or staining.

The use of specific disinfectants for a specific job is an individual problem that should be discussed with a person knowledgeable in that field. Extension agents, veterinarians and pharmacists are good sources of information on how to use these products.

CLEANING AND DISINFECTION

Member Activity: Complete the following information about the reading material and your animal.

1. Explain what each of these terms mean:
   a) cleaning _____
   b) disinfection _____
   c) sanitation _____
   d) detergents _____
   e) organic matter _____

2. Give the correct formula for disinfection and explain what each part means.

3. How does the presence of organic matter lower the effectiveness of a disinfectant?

4. Name some sanitary practices you can carry out to keep your animal and yourself from spreading germs.

_____

_____

_____

_____

5. Explain the disinfection measures you use in your project and why you use them.

_____

_____

_____

_____

Extra Activity:

A. Demonstrate at a meeting the ease of cleanliness and the time saved by cleaning a soiled board or piece of equipment with detergent and water as compared to detergent alone. Also explain how you would now disinfect it.

B. Make a file on various available disinfectants. Include where they should be used, and how.

CELLS OF THE ANIMAL BODY

Words to Know:

anatomy: the form or structure of the body or cell

cells: the basic unit of living matter. Carries on life activities.

cytoplasm: protoplasm that is inside the cell but outside the nucleus. The different parts of the cells (with the exception of the nucleus) are found in the cytoplasm.

physiology: the ways in which the parts of living things work.

protoplasm: the living part of the cell. It is a clear, thick substance.

specialization: performs one function. This would be like a doctor that only operates on feet, he or she specializes in feet.

After reading this section you should be able to answer the following questions:

- What is the basic unit of living matter? In other words, what makes up every living thing?
- What is protoplasm?
- What are the three main parts of the cell and the most important job of each?
- What is specialization? Be able to give three examples.
- What are the basic life activities carried on by every living cell?

THE CELLS OF THE ANIMAL BODY

To maintain and care for anything you own, you must know how it is made and how it works. For proper care of your animal, a basic knowledge of anatomy and physiology is necessary in helping you understand how your animal lives and functions.

The term **anatomy** refers to the form and structure of the body or cell, that is what the cells look like or how the body is put together. Physiology deals with the function of the body or any part of it. In other words, how things work.

THE BODY

Both human and animal bodies are made up of billions of cells, each having a job to perform to keep the animal alive and healthy. Much of what we know today about the living cell dates back to a little more than 100 years ago when scientists discovered the cell as the basis for all living matter. With the use of the microscope and, more recently, the more powerful electron microscope, we are learning that the cells each have a special purpose. Cells are capable of reacting to many physical, chemical and mechanical stimuli.

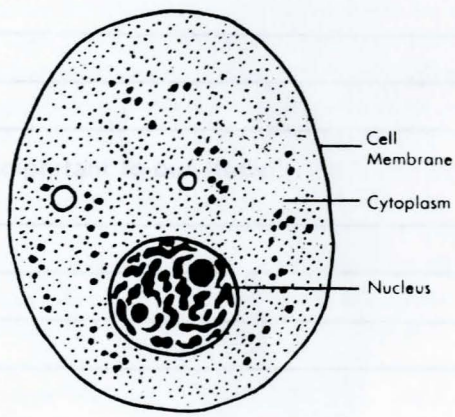
PROTOPLASM

The basic building material in each cell of the body is a substance called **protoplasm.** It is a semi-transparent, jelly-like substance containing granules or fibers. Protoplasm is the living substance of the cell and is the physical basis of life. It carries on life functions such as growth, reproduction, response to stimuli (such as light or heat), contraction (shortening in one direction) and digestion of food. Protoplasm is composed of many elements such as oxygen, hydrogen, nitrogen, and carbon which are then combined chemically to form compounds that are alive.

Only living protoplasm has the ability to take in materials it needs, and by rearranging the chemicals, change them into its own substance. This process of converting food or chemicals into living protoplasm is called **anabolism** or **assimilation** and results in body growth, cell function and repair. So when your animal digests the food that it eats, the protoplasm in its body cells selects the chemicals or nutrients needed and builds them into its own kind of protoplasm.

PROTOPLASM AND THE CELL

You know the contents of a cell are called protoplasm. Protoplasm is put together to form the very small units that make up living things. The protoplasm makes up the three main parts of the cell. These are: (1) the **cell membrane;** (2) the **cytoplasm;** (3) the **nucleus.** See figure 6 for an illustration of these parts.



6.1 A single cell, many times its actual size.

The Cell Membrane. The cell membrane is the wall around the cell. It encloses or creates a wall around the cytoplasm and the nucleus. It has tiny pores (openings) which only certain kinds of chemical mole-

cules can pass through. This controls the movement and exchange of food, respiratory gases and waste between the cells and fluids of the animal's body.

Cytoplasm. The cytoplasm forms the greatest part of the cell and includes all the protoplasm outside the nucleus. If you look at figure 6, you will notice that more than the three parts discussed here are labeled. The cell is extremely complicated and so complex that some biologists specialize in studying the cell or even just one part of the cell. Because of this complex nature, we are labeling everything between the nucleus and the cell membrane as the cytoplasm. The main thing to remember is that all of those organelles, as they are called, are part of the protoplasm.

The Nucleus. The nucleus is a very important part of the cell. It contains the chromosomes (the genetic material) of the cell, which is important in heredity. These chromosomes guide the way in which living things grow, determine the sex of the animal, and make it possible for cells to reproduce and make new living cells like themselves. The nucleus also controls the cell's life functions. It is for these reasons that many times you will hear the nucleus called the "brain" of the cell.

The Cell. The cell is the main unit of structure of all living things. Cells make up all living things, no matter how small or how large they may be. Some microscopic animals in the world may be made up of only one or two cells, but most of the animals we know contain billions upon billions of cells. An important point to remember is that all cells carry on life functions. In other words, every cell in all animals will divide (reproduce), digest food, and grow. But for these life functions to continue, very complex chemical reactions must occur. And they must occur in a certain order and in an exact amount or the cell will die or function improperly.

Even though all living things are made up of cells, all cells are not exactly alike. Each species or group of animals have cells that are different than other groups. For instance, the cell structure of the cat is different than that of a turtle. The cat's and the lion's cells look more alike than the cat's and the turtle's because the cat and the lion are more closely related.

The cells in an animal's body must specialize to perform certain jobs. In Lesson VII, cell specialization is discussed in more detail, describing many different kinds of cells, each highly developed for a particular kind of activity.

SUMMARY

The information that we have presented to you in this chapter is very basic. However, it is extremely important that you understand the following concepts:

- All living things are made up of cells.
- The basic material that makes up cells is called protoplasm.
- Protoplasm is then put together to make up the different parts of the cell.
- There are three main parts to the cell: the cytoplasm, the nucleus and the cell membrane.
- Each cell carries on life functions. In other words, each cell does what is necessary for it to live.
- Cells also are specialized to perform certain jobs.
- Cells together form tissues.
- Tissues together form organs.
- Organs together form systems.

CELLS OF THE ANIMAL BODY

Member Activity: Complete the following information about the reading material.

1. Why is understanding this information important to the care of your animal?

2. What is a cell?

3. Explain what protoplasm is.

4. What are the three main parts of the cell? Name one important point about each.

5. What is meant by the phrase "all cells carry on life functions"?

6. What does the word specialization mean? Why is this work important to our study?

7. What is a tissue?

Unit I, Lesson VII

THE TISSUES OF THE ANIMAL BODY

Words to Know:

tissues: a group of similar cells organized to perform similar activities.

organs: a group of tissues working together to perform a particular function.

contraction: a drawing together, a shortening or shrinkage.

matrix: the basic supporting material secreted by cells from which a tissue develops. The cells are, therefore, suspended or held in place by matrix.

system: a group of organs working together to carry out a certain function.

After reading this section you should be able to answer the following questions:

- Cells are organized into what?
- What is the function of tissues?
- Name the four basic tissues and give their function plus an example of each.
- Explain the differences between voluntary and involuntary muscles.
- What are the major types of muscle tissues and how do they differ?
- What are organs?

THE TISSUES OF THE ANIMAL BODY

In multi-celled plants and animals, cells are organized to carry on the life processes. When groups of cells are organized like this, they are called tissues. Defined another way, a tissue is a group of similar cells performing a similar activity. An animal body is made up of four basic tissues, each of which contributes to a smoothly working unit. The four tissues are **epithelium** (ep-i-the-li-um), **connective tissue, muscle tissue,** and **nerve tissue.** Under a microscope, the differences between the tissues can be clearly seen. Sometimes the differences are so great that you can identify the tissue by looking at them without a microscope.

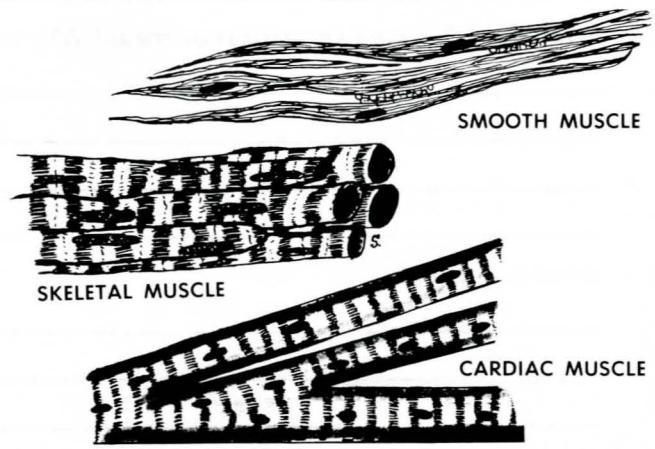
Epithelium. This tissue provides the inner and outer surface linings for the different parts of the body. The skin, for example, is made of one type of epithelium. This type is made up of cells that are tough and protective. There are other types of epithelial tissue found in other organs throughout the body. These are also specialized for certain jobs. Some of these specialized jobs include producing fluids that may keep the lining moist or aid in the digestion of food. Still other jobs include the secretion of mucus (a lubricative protectant), saliva, or hormones necessary for the life process.

Connective tissue. The job of this type of tissue is to connect and hold together other tissue and body parts. Connective tissue includes bones, ligaments, tendons, sublayers of skin, cartilage and even blood.

The cells of connective tissue secrete a substance which surrounds them. This substance is called **matrix.** The matrix adapts to the function of the body part where it is found. For example, tendons are tough and strong. Their job is to connect muscle to bone. The matrix of tendon cells is fibrous, as is the matrix of ligament cells. Ligaments connect bone to bone at the joints. The matrix of some connective tissue, like cartilage, is elastic or rubbery. The cartilage cells secrete fibers which become embedded in the matrix and strengthen it. This is why the human ear and nose, which are made mostly of cartilage, feel firm but elastic. This is also why cartilage, feel firm but elastic. This is also why cartilage can be found in the spinal column. The cartilage gives the spine strength, which it must have for obvious reasons, yet provides it with some flexibility. Bone matrix is very hard, to fit its job of giving bones strength.

Muscle tissue. This tissue is specialized for contraction. The cells of muscle tissue are long and have the ability to contract (pull up) quickly. When they contract, or become shorter, they cause movement of some part of the body.

Muscle tissue can be broken down into three distinct types found in the animal's body: skeletal, smooth and cardiac. Now remember, these are **all** muscle tissue, so they are all made of long cells that become shorter and thicker during contraction. It's just that there are differences between them that allow them to be separated further. Since this is a lot of information to be absorbed at once, the following chart on muscle tissue helps to summarize it.



7.1 **Diagram of the 3 muscle cell types, greatly enlarged.**

Skeletal: As the name indicates, skeletal muscles are found attached to bones by tendons. These muscles move the bones when they contract. This type of muscle is sometimes called **voluntary** muscle, because it is under the control of the brain. If an animal wants to move its leg, the voluntary muscles respond to the brain impulse and the leg moves. If you look at skeletal muscle under a microscope, it has cross striations. This means that there are light and dark bands running across the muscle fibers. So we call skeletal muscle striated.

Smooth: When you see smooth muscle under a miscroscope, it looks just like its name, smooth. It has no striations. Smooth muscle may be found in the digestive system, blood vessels, and the uterus. An animal obviously does not have to tell its stomach to digest the food it has just eaten. Smooth muscles are not controlled by the animal's will, so they are called **involuntary.**

Cardiac: Cardiac muscle is found only in the heart. Since an animal cannot control its heart as it could its leg, this type of muscle is also involuntary. The muscles of the heart have cross striations as skeletal muscles do.

COMPARISON OF TYPES OF MUSCLE TISSUE

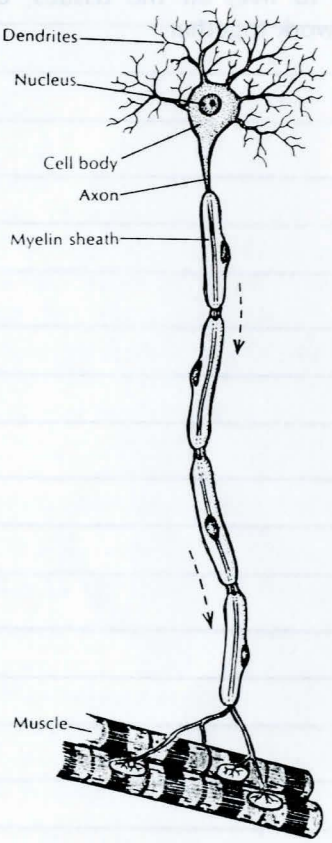
	skeletal	*smooth*	*cardiac*
Location	attached to skeleton	walls of organs	heart walls
Cross striations	present	absent	present
Speed of contraction	most rapid	slowest	intermediate
Type of control	voluntary	involuntary	involuntary

Nerve tissue. Nerve tissue makes up the brain spinal cord and the nerves. This tissue is specialized for sending messages through the body. This function permits the animal to know what is going on in the various parts of its body and in its environment. If it is cold outdoors, a message is sent from the nerve cells in the skin to the brain, by way of the spinal cord, telling the animal to find a warmer place.

Remember that tissues are made of cells. The cells that make up nerve tissues are called neurons. They are specialized for conducting impulses to the brain and from the brain. Each neuron has a cell body, containing the nucleus, and two or more nerve fibers extending from the cell body. The nerve fibers are made of cytoplasm and are covered by a cell membrane, as are all cells. There are two types of nerve fibers: **Axons** carry nerve impulses away from the cells, and **dendrites** carry nerve impulses to the cell.

The nerve tissue containing neurons are connected in chains. These chains pass impulses for long distances through the body. Two consecutive neurons do not actually touch as do two strands of copper wire spliced together to carry an electrical impulse. There is a small gap which is called a synapse between them. The synapse regulates the transmission of impulses from one neuron to the next.

A nerve carrying an impulse from the senses or nerve ending to the brain is called a sensory nerve. Nerves that take messages from the brain to move a body part or a muscle are called motor nerves.



7.2 **A nerve cell attached to a muscle cell, greatly enlarged.**

ORGANS AND SYSTEMS

Organs are well defined parts that perform certain functions. Examples of organs are the heart, liver, brain and stomach. An organ is made up of several kinds of tissues, including a certain amount of nerve tissue which controls the function. For example, the stomach is made up of smooth muscle tissue, is covered with one type of epithelium and lined with another type of epithelium. It is supplied with oxygen and nutrients by blood, which has its origin from connective tissue. And, the function of the stomach is controlled by nerve tissue.

Organs which work together to carry out the same general function, form systems. Let's go back to the example of the stomach. The general function of the stomach is to break down food for use by the body. Other organs with this same general function include the small intestine, liver, gall bladder and large intestine. These organs together make up the digestive system. Each of the organs have their own special job, but the general function is the same so they are grouped together.

In animals, even a highly specialized tissue cannot perform a life activity to perfection all by itself. So if the animal is to live, all the tissues, organs, and systems must work together.

SUMMARY

Make sure you understand the following ideas before going on:

- Cells with similar functions group together to form tissues.
- There are four basic tissues: epithelium, connective, muscle and nerve.
- The function of epithelium is to provide the inner and outer surface linings for the various parts of the body.
- The job of connective tissue is to connect and hold together other tissue and body parts. In other words, it connects, just like its name says.
- Muscle tissue causes movement of some part of the body by contracting.
- Muscle tissue can be broken into three groups: smooth, skeletal and cardiac.
- Nerve tissue's function is to send messages throughout the body. This lets the animal know what is going on not only within its own body, but also in its environment.
- Organs are several tissues together which act to do one job.
- Along the same lines, organs which work to carry out the same **general** function form systems.
- For an animal to stay alive, all the cells, tissues and organs must work together.

THE TISSUES OF THE ANIMAL BODY

Member Activity:

Define these words:

1. Tissue _____
2. Organ _____
3. System _____
4. Matrix _____
5. Contraction _____
6. Voluntary muscle _____
7. Involuntary muscle _____
8. Striated _____
9. Neuron _____
10. Axon _____
11. Dendrite _____

12. Synapse _____

13. Sensory nerve _____

14. Motor nerve _____

Fill in the graph below.

Tissue	Function	Where found	Name one other thing
15. Epithelium			
16. Connective tissue			
17. Muscle tissue			
18. Nerve tissue			

19. Name the three types of muscle tissue and tell one thing about each.

20. Explain what would happen if a nerve was cut or injured in some way.

21. Explain what would happen if a nerve leading to a leg of an animal was injured.

Unit I, Lesson VIII

THE ORGANS AND SYSTEMS OF THE ANIMAL BODY

Words to Know:

A.V. valve: (atrio-ventricular) controls the flow of blood between the atrium and the ventricle in the heart.

monogastrics: animals with only one stomach.

organs: a group of several kinds of tissues combined to perform a particular function.

oxygenated: containing or saturated with oxygen.

pulmonary: to do with or associated with the lungs, such as pulmonary vessels are going to or coming from the lungs.

ruminants: one of a group of animals characterized by having a four compartment stomach.

system: a group of organs working together to carry out a certain function.

After reading this section you should be able to answer the following questions:

- Tissues are grouped to form what? These are then grouped to form larger groups called what?
- Define the term system. Give 5 examples.
- Explain the purpose of the digestive, respiratory and circulatory systems.
- Trace the movement of blood through the body. How are the circulatory system and respiratory system interrelated?
- How are the digestive system and the circulatory system interrelated?

THE ORGANS AND SYSTEMS OF THE ANIMAL BODY

Just as tissues combine to form organs, organs combine into even larger groups called systems. A system is made of a set of organs and other structures that work together in carrying out a certain function. The digestive system, for example, performs functions related to the preparation of food for the body. It is made of many organs, including the stomach, liver, pancreas and intestines. These organs and their tissues are all working together to perform a specialized function. As another example, the arteries, capillaries, veins, lymph vessels and the heart form the circulatory system. Their job is to transport nutrients and other materials in the blood to and from cells.

The systems of the body and their function are:

- Digestive system: break down and absorption of food.
- Circulatory system: transportation of blood, oxygen, waste, and nutrients.
- Respiratory system: breathing in oxygen and release of carbon dioxide.
- Excretory system: elimination of waste products.
- Muscular system: motion and locomotion.
- Skeletal system: support and locomotion as well as protection.
- Nervous system: sensation and moving.
- Reproductive system: reproduction.
- Integumentary system: also known as the skin. Covers and protects the entire body.
- Endocrine system: these are the glands and their secretions. They help coordinate body function.
- Sensory system: eyes, ears, touch, taste, smell.

As you can see, there are many systems in the animal's body. We will not try to discuss all of them, only parts of four (sensory, digestive, respiratory and circulatory systems). These are important as a veterinarian has many calls concerning these four systems. Therefore, you should be familiar with them. Remember, one of the objectives of this project is to help you learn how to help your veterinarian by communicating with him more effectively. Early recognition of trouble and contact with your veterinarian may save your animal's life.

All of the systems are very interesting. It would be desirable for you to study all systems of the animal body to learn and better understand how the animal functions. You should also become especially familiar with the skeletal, muscular, nervous and reproductive systems of your project animal.

We also need to emphasize that each system does not work alone. All systems are interrelated and must work together for the animal to survive.

THE EYE - SENSE ORGAN - A PART OF THE SPECIAL SYSTEMS

The function of the eye is to form an image that an animal can see.

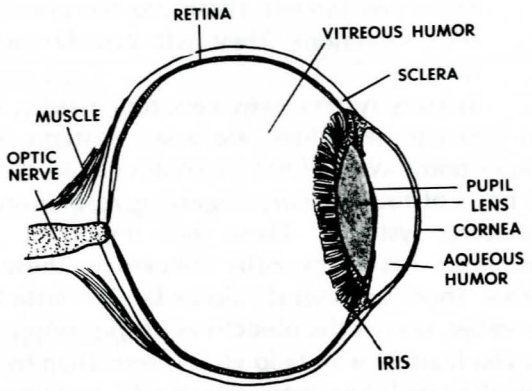
The eyelid is the most exposed part of the eye. It is a movable fold of skin which covers and protects the eyeball. When you look at some animals you may see a small pink portion of flesh on the inside corner of the eye. This is called the third eyelid or nictitating membrane. Frequent flicking of the third eyelid serves to remove dust and other foreign particles from the eye surface.

The mucous membranes are the soft, pink, moist surfaces that line the eyelids and are attached to the upper part of the eyeball. Their purpose is to bring a

blood supply to the area, lubricate and provide a soft, movable membrane to protect the eye.

In each eye there is a tear gland which secretes tears, and a tear duct to carry the overflow of tears into the nasal cavity. Tears are constantly secreted, but usually in small quantities that drain into the nose. Tears help remove dust and foreign matter from the eyeball, and keep it moist.

The eyeball itself is composed of two main parts. The front part is the cornea or window of the eye. It is clear and oval in outline. The sclera, or white of the eye, is a tough, curved membrane that supports and contains the other portions of the eye. Inside the eye, behind the cornea is the color portion of the eye, or the iris. The iris can relax or contract, making the pupil adjust in size to control the amount of light entering the eye.



8.1 The eye.

Just behind the iris is the lens, a thick, clear, elastic structure that aids in focusing light. It is held in place by muscles. The inner back portion of the eye is covered by the retina. The retina contains nerve endings that connect to the optic nerve. The cavity between the cornea and the lens is filled with a watery fluid, the aqueous humor. The large chamber between the lens and retina is filled with a thick liquid, the vitreous humor. Both fluids are important in maintaining the shape of the eyeball, and aid in focusing of light within the eye.

The optic nerve comes from the brain and enters the rear of the eyeball. It expands into many branches and attaches to the delicate and sensitive retina.

When light rays fall upon an object, they are reflected and enter the eye through the cornea and pupil. When these rays reach the lens, they are bent, so that just after they pass through the fluid part of the eye (vitreous humor), they focus upon the retina. The nerve endings that spread out over the surface of the retina are stimulated, and the impulses are carried by the optic nerve to the brain. In the brain, all the impulses are combined and the person or animal experiences the sensation of sight.

An important thing to know is that eye infections are common and they are usually on the cornea or outer surface of the eye. Permanent damage can occur if proper care of the eye is delayed. Scarring of the cornea can obstruct light from entering the eye. This causes a partial or complete blindness.

DIGESTIVE SYSTEM

The digestive system consists of a continuous muscle-membrane like tube that extends from the mouth through the body and ends at the anus. Its functions are ingestion (taking in of food), grinding, digestion (breaking down of food), and absorption of food and elimination of solid wastes. Food is broken down into simple compounds that the cells of the body can use. Food is moved through this tube by both voluntary and involuntary muscles. While the food is moving, nutrients are absorbed by the bloodstream to be carried through the body and to all the cells. This is one example of two systems working together.

The digestive system starts with the mouth and the teeth which have several functions. Primarily they are used for chewing, however, in some animals they are used as a prehensile (grasping) organ to tear off or obtain food.

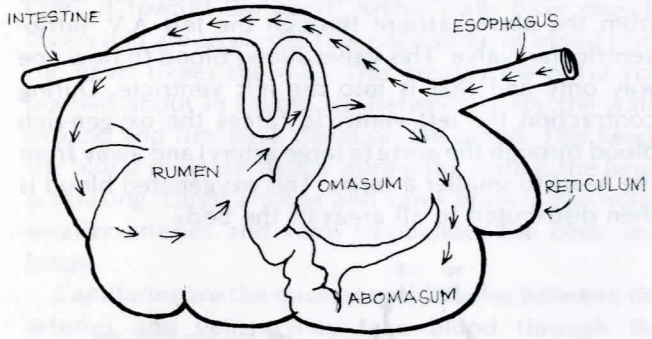
The teeth are very important in keeping the animal healthy. Sometimes the teeth can be so poor or misaligned that neither grinding or obtaining food can occur. If the problem is not corrected, severe weight loss or death can occur. The teeth may be classified as incisors (cutters) or molars (grinders) and since their function is so different, their structure is also different. The growing and breaking out of the teeth through the gums is called eruption. Most animals have eruption of one set of temporary teeth (baby or milk teeth) while very young, then during the next few years these are replaced gradually by permanent teeth. The approximate age of some animals is determined by whether the teeth are temporary or permanent and also by the wear that has occurred on the grinding (chewing) surface. The shape of the teeth of a meat-eating animal are different than those of a grass eater.

Following chewing, the food passes into the stomach and is digested by means of complex chemical processes. Aiding the chemical processes are involuntary muscle actions in the digestive pathways that move the food. Pathways found in ruminants, such as sheep, goats, and cattle, are different that those found in non-ruminant, single stomach (monogastric) animals such as pigs, dogs, horses, and humans.

Pathways in Ruminants

We'll use the cow here as an example of a ruminant. The cow has four "stomachs". The food passes from the mouth to the esophagus (food pipe) to the reticulum, rumen, omasum and abomasum (true

stomach). The cow is equipped to digest large amounts of hay or *roughage* to obtain enough **nutrients** to maintain her requirements.



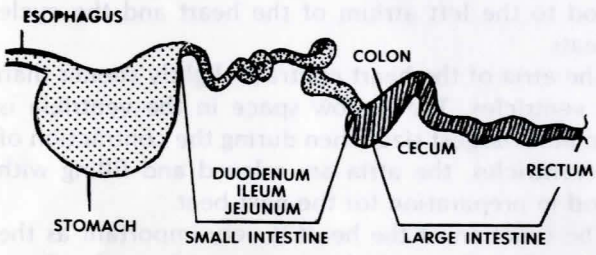
8.2 A ruminant stomach has four compartments.

After eating, cows are capable of regurgitating part of the hay that has been eaten so it may be chewed again. This is called chewing the cud (rumination). During this process over a few hours, a tremendous amount of saliva is mixed with the food to aid digestion. After the food has been chewed thoroughly and passes to the rumen (note illustrations), muscular contractions move and mix the food, while rumen bacteria help digestion.

The bacterial action (fermentation) and other digestion takes one to three days to complete. Nutrients for body use are absorbed after the food is passed on through the abomasum and into the intestinal tract. The remaining material is then passed on as waste or feces.

Pathways in Nonruminants (Monogastrics)

Compared with the time required for cattle, the 24 hours required for food to pass through the digestive tract of a dog or pig is short. Pigs and dogs do not have a rumen where food can be stored while it is digested. Neither do they ruminate or chew a cud. These animals must chew their food for good digestion before it is swallowed, which allows enzymes in the mouth to mix with the food. Saliva also is important in aiding digestion in the nonruminant. The pig and some of the other animals with single stomachs (monogastrics) are capable of digesting much richer (concentrated) feeds and, therefore, do not need the tremendous volume of food to digest for their needs.

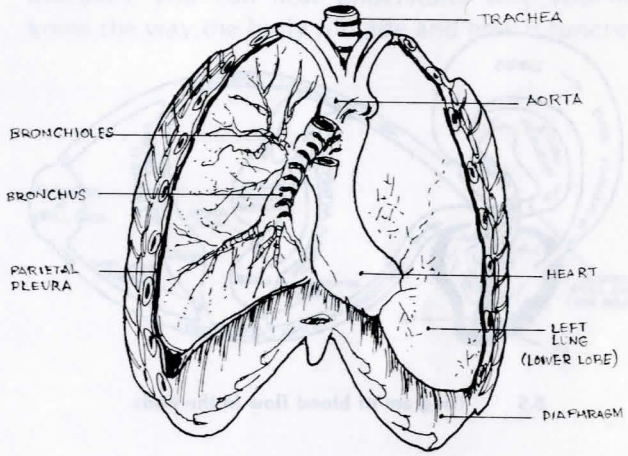


8.3 A monogastric animal has a single stomach.

From the mouth, the food passes down the esophagus into the stomach. It then passes through the small and large intestines. During the time the food is in the intestines, nutrients are absorbed. Any remaining material is passed through the rectum and out of the body as wastes.

RESPIRATORY SYSTEM

The purpose of the respiratory system is to carry air in and out of the lungs so that oxygen can be brought into the body and carbon dioxide and other waste materials carried off. The organs of respiration of most animals consist of the nasal cavity, pharynx, larynx, trachea, bronchi and the lungs. The lungs are the most important organs of respiration. All of the other parts act as passages for the air. They clean and adjust the temperature of the air entering the lungs.



8.4 The heart and lungs inside the rib cage.

In most animals, the nasal cavity is the passageway that opens to the outside through the nostrils. It is separated from the mouth by the palate (roof of the mouth), and is connected to the pharynx. The pharynx, or throat cavity, connects the nasal cavity with the larynx and trachea. It then continues from the trachea to the lungs.

In the pharynx, the pathways of the digestive and respiratory systems are one and the same. Food passes from the mouth through the pharynx to the esophagus and stomach, and air passes from the pharynx to the larynx and trachea. To prevent food from passing into the larynx, a flap of tissue, the epiglottis, folds over the opening to the larynx when food is swallowed. This is done automatically, but sometimes fails. When this happens, the animal coughs and chokes until the food is expelled from the air passage back into the throat. Occasionally death can occur from blocking the air passage if this object is not coughed up.

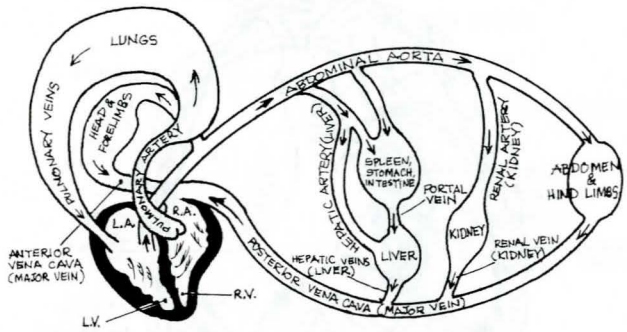
The vocal cords are contained in the larynx, or voice box. These cords are folds of tissue that vibrate as air passes over them, thereby producing sounds. Voice changes can occur by changing the tightness of the vocal cords.

Within the lungs are small air sacs. It is on the surface of these sacs that oxygen from the incoming air is absorbed and exchanged with carbon dioxide waste from the blood. Here again you can see where two systems are interrelated.

This exchange of oxygen is severely hindered when the lung is infected. An infection of the lungs is called pneumonia, one of the most common diseases treated by veterinarians.

CIRCULATORY SYSTEM

The circulatory system is comprised of a pump (the heart) to move the blood, and a system of tubes (blood vessels) to carry blood from and back to the heart. The blood acts as a transport system. It carries oxygen and nutrients to all the cells of the body. It also carries wastes and carbon dioxide away from the cells.



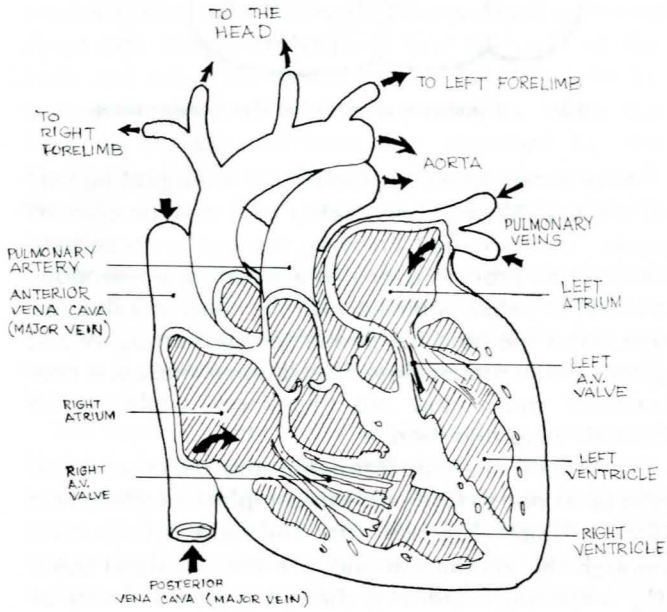
8.5 Diagram of blood flow in the body.

Blood vessels that carry blood away from the heart are called arteries and vessels carrying blood to the heart are called veins.

The Heart

The heart is a very strong muscular organ and is made from cardiac muscle tissue. It must work continuously and the only rest it gets is between beats. Each beat is actually a contraction and relaxation of this hollow muscular organ. When blood is within the hollow space and a beat occurs, blood is forced through the vessels due to reduction in size of this space. The speed at which it beats varies and is increased or decreased in proportion to the work or stress the body is doing at a specific time. For instance, the speed of an animal's heart increases if it is running or in an unfamiliar situation. The speed decreases when the animal is asleep. As you have learned, the heart is made of involuntary cardiac muscle tissue and will, therefore, speed up or slow down in spite of your wishes or will.

The heart is divided into four chambers. These are laid out on a left side and a right side. The two top chambers in the heart are called auricles or atria. The two bottom chambers are called ventricles. The chambers are further named according to whether they are found on the right or left side. The chamber on the top of the left side is called the left atrium. It is into this chamber that fresh oxygenated blood in the pulmonary veins is returned from the lungs (respiratory system). Directly below the atrium is the left ventricle which accepts the oxygen rich blood from the above atrium through the left A.V. (atrioventricular) valve. This valve allows blood to flow one way only and that is into the left ventricle. During contraction the left ventricle forces the oxygen-rich blood through the aorta (a large artery) and away from the heart to smaller arteries. This oxygenated blood is then distributed to all areas of the body.



8.6 The four chambered heart and major vessels.

The right side of the heart is similar to the left. However, its function is to receive the blood which contains carbon dioxide from the veins of all body areas. Carbon dioxide is a waste product after oxygen has been utilized. This venous blood is received by the right atrium and is passed through the right A.V. (atrioventricular) valve into the right ventricle. Again, the valve allows the blood to flow into the ventricle only. Then when the right ventricle contracts the blood is forced into the pulmonary artery. The blood goes to the lungs and releases its carbon dioxide and will pick up new oxygen. This completes the cycle for oxygenation. The pulmonary veins again return oxygen rich blood to the left atrium of the heart and the cycle repeats.

The atria of the heart contract slightly sooner than the ventricles. The hollow space in the ventricle is then at its largest size. Then during the contraction of the ventricles, the atria are relaxed and filling with blood in preparation for the next beat.

The function of the heart is very important as the body cells will die if blood is not able to distribute food nutrients and oxygen properly. A malfunction of

valves or improper contractions can cause serious problems in man and animals.

Arteries, Capillaries and Veins

Arteries carry blood away from the heart, veins carry it toward the heart. Artery walls have muscle layers and are so elastic that each surge of blood from the heart flexes the wall. This creates the pulse you learned about in Lesson III. Between beats, the walls expand and flex back down on the blood. This keeps the blood pressure steady during the instant the heart is relaxing. Large arteries and veins branch into many smaller arteries and veins throughout the body and lungs.

Capillaries are the microscopic tubules between the arteries and veins. They take blood through the tissues. In a capillary, only a thin, single layer of cells contain the flowing blood. Through the thin walls of capillaries, blood delivers vital substances to the tissues and picks up their waste products. Arteries and veins serve only to get blood to and from the vital exchange centers at the individual cell level.

Veins do not help regulate blood pressure and thus do not need a thick wall. Veins lack the thick, muscular walls of arteries. They have thinner walls and larger inner cavities to carry the slower moving blood.

Veins are nearer the outside surface of the body and have lower blood pressure. Because of these two facts, larger veins are often used by the veterinarian to introduce medicine or draw blood samples. This can aid in the treatment or diagnosis of disease.

The discussion of these four systems should help you in seeing disease signs early so prompt corrective measures can be started. This material is only a beginning, as the systems are very complex. For more information, many books of anatomy and physiology are available in schools and libraries. To prevent serious mistakes, you can now understand why you must know the way the body is made and how it functions.

THE ORGANS AND SYSTEMS OF THE ANIMAL BODY

Member Activity:

1. Define these words:
   a) monogastrics _____
   b) artery _____
   c) vein _____
   d) heart _____
   e) iris _____
   f) mucous membranes _____
   g) nictitating membrane _____
   h) vitreous humor _____

i) aqueous humor _____

_____

_____

j) retina _____

_____

_____

k) epiglottis _____

_____

_____

2. From your reading in this lesson you have seen how two or three systems can be interrelated. Using this information, explain what happens in an animal's body when its heart stops and its blood stops circulating

_____

_____

_____

_____

3. Draw a picture of the eye and label the parts.

_____

_____

_____

_____

4. Name three of the systems listed and explain the function of each.

_____

_____

_____

_____

5. Where do tears drain?

_____

_____

_____

_____

Possible Exhibit Projects for Veterinary Science

4-H Project - The Normal Animal

1. Photographic exhibit of normal and abnormal characteristics of animals.
2. Exhibit of samples of leather or fur damaged by unhealthy or parasitized skin.
3. Exhibit charts showing temperature, respiration, and heart rate changes under varying conditions.
4. Exhibit showing disease preventive health procedures by use of proper nutrition and other management decisions.
5. Safety exhibits concerning handling of chemicals used in animal health and disinfection.